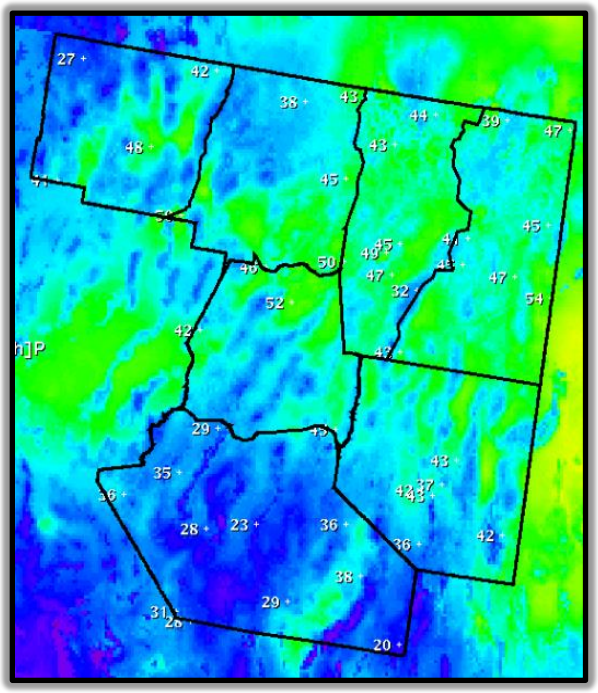
Fire Weather Holdover Threat Index (HoTI) Forecast Documentation Page

The National Weather Service in Elko, NV has created an experimental index forecast called the Holdover Threat Index (HoTI). The purpose of the Index will be to provide heightened situational awareness to customers/partners and NWS forecasters to days when meteorological conditions are favorable for smoldering fires to grow.

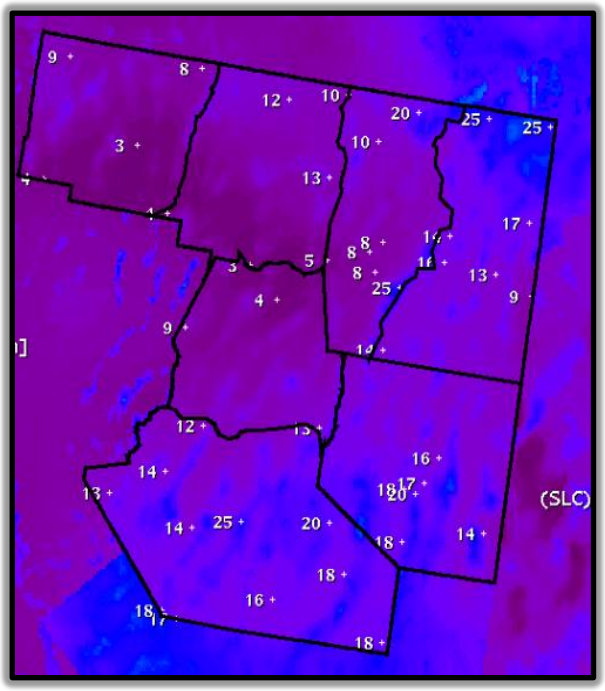
The index takes into account the following variables and combines them into one all-encompassing, visually simple product. All variables will be explained below.

1. Relative Humidity and Wind Gust Threat

At least twice per day, NWS forecasters create gridded forecasts of minimum relative humidity and wind gusts. The HoTI graphic creation will be based off of the 4 a.m. PDT minimum relative humidity and wind gust forecast. These forecasts look something like this:

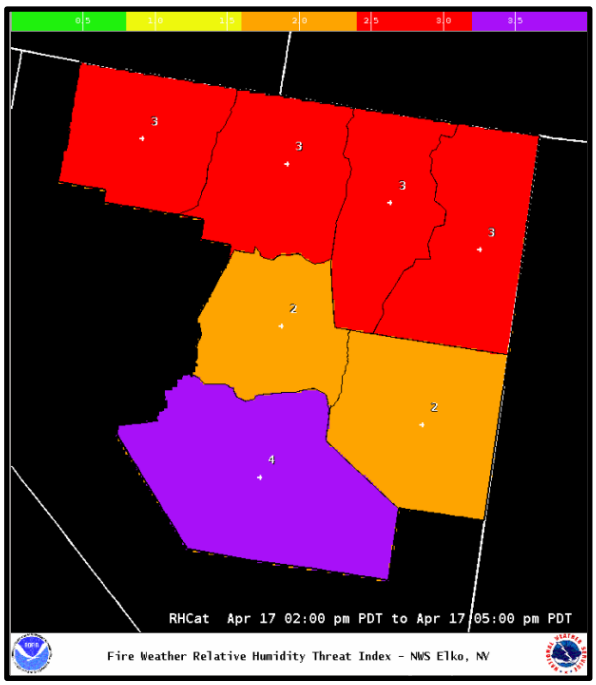


Minimum Relative Humidity Forecast

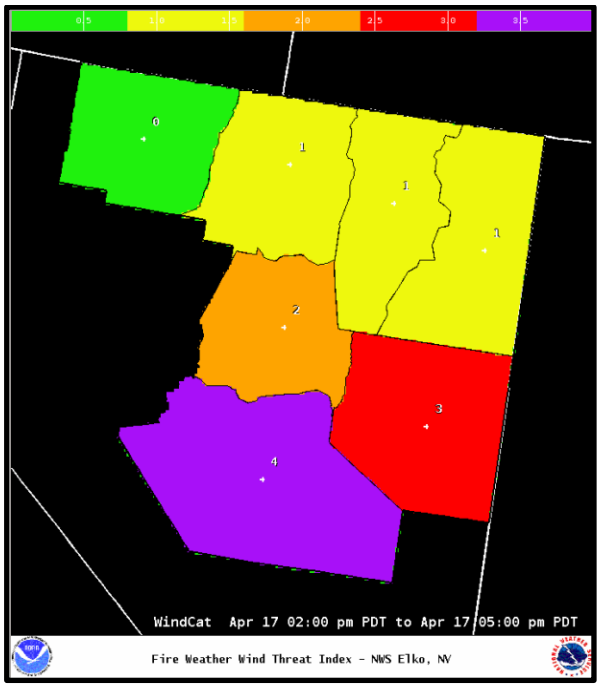


Max Wind Gust Forecast

For the new HoTI forecast, the minimum relative humidity (lowest relative humidity values for the entire day) and wind gust forecasts (highest wind gusts during peak heating) will be averaged for each fire weather zone. Based on the average zone relative humidity and wind gust value, a pre-weighted threat index value is assigned to each fire weather zone. Please look at table 1 and 2 below for what relative humidity and wind gust values equal what threat values. An example of the zone assigned threat values is shown below (RH on the left and winds on the right):



Example RH Threat Index



Example Wind Threat Index

The index values will range from 1 to 4, with the following nomenclature for minimum relative humidity and wind gusts, respectively:

Threat Level		Min R.H.	Threat Value
	None	>25%	0
	Limited	16-25%	1
	Moderate	11-15%	2
	High	6-10%	3
	Extreme	< 6%	4

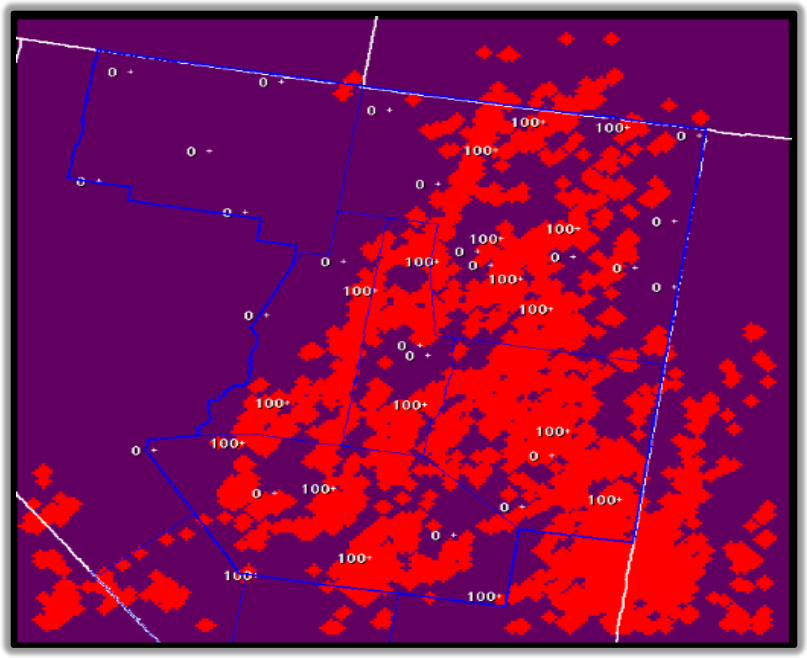
Table 1

Threat Level		Wind Gusts	Threat Level
	None	<15 mph	0
	Limited	15-20 mph	1
	Moderate	21-25 mph	2
	High	26-30 mph	3
	Extreme	>30 mph	4

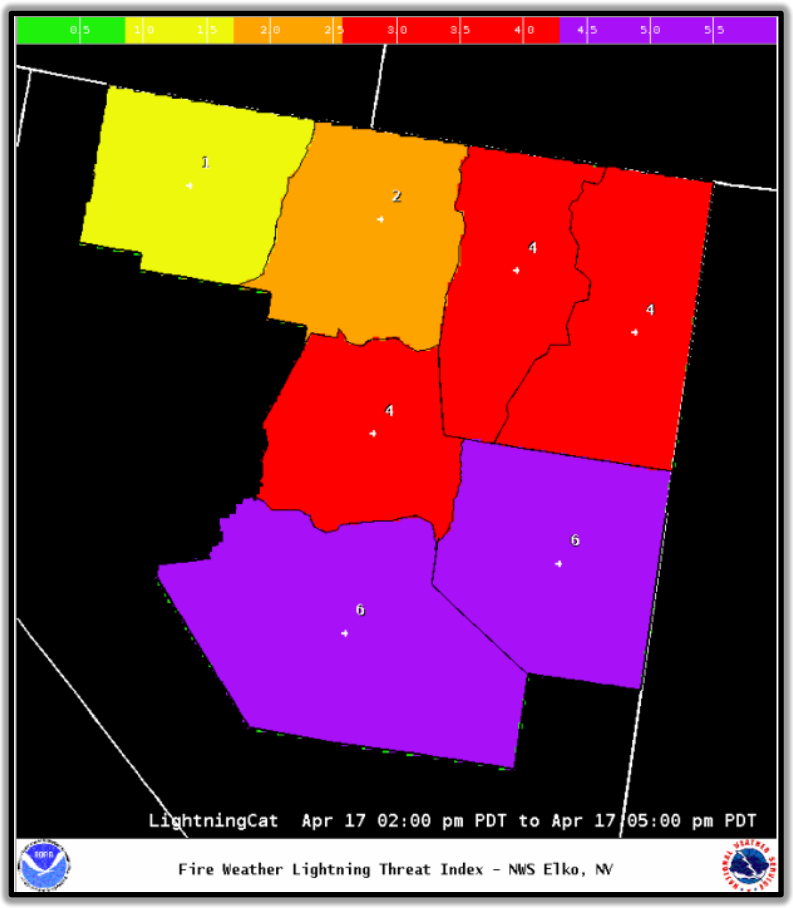
Table 2

2. Lightning Coverage Threat Index

This threat index takes into account the amount of areal lightning coverage from the previous day's lightning (5am to 5am). The lightning strikes that hit in each zone are tracked and then assign an effective coverage area of 5.1km for each strike. An example of a widespread lightning outbreak map with an effective area of 5.1km for each strike is shown below. Each strike with its 5.1km area is added up, which equates to the entire area for that zone that has been impacted by lightning strikes. This area is divided by the entire land area for that fire weather zone, which results in a percent value of the areal coverage for each fire weather zone. For further details on the methodology of calculating the areal extent of lightning coverage, please read the following paper at this link: http://www.wrh.noaa.gov/media/wrh/online_publications/TAs/TA0902.pdf. Based on the areal coverage, a threat value will be assigned for each fire weather zone. Values for areal lightning coverage are shown in Table 3 below. As you can see, the lightning coverage threat index values are more heavily weighted when compared to both the max wind gust and minimum relative humidity values. Thus, large lightning outbreak days will have a higher overall Holdover Threat Index value.



5.1km effective area lightning coverage map example



Lightning Threat Index Graphic Example

Threat Level		Areal Lightning Coverage (ALC) (Percent of Zone using 5.1km radius)	Threat Value
	None	0%	0
	Limited	1-10%	1
	Moderate	11-15%	2
	High	16-20%	4
	Extreme	> 20%	6

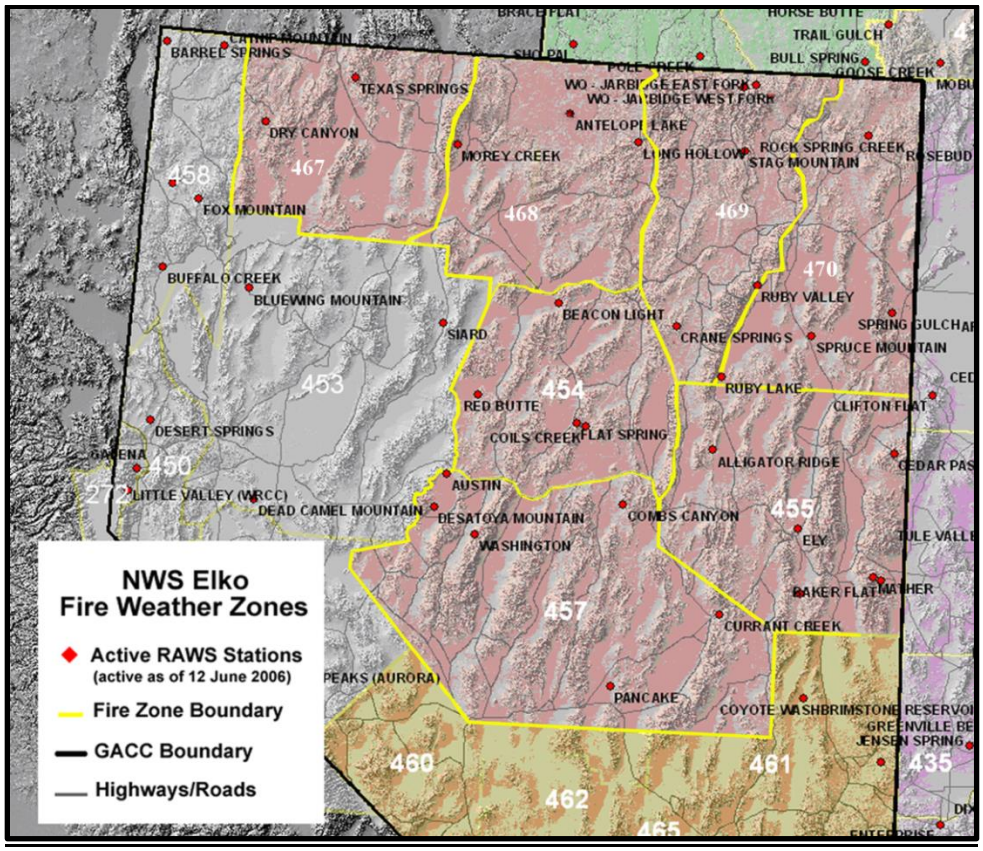
Table 3

3. Dryness Grid

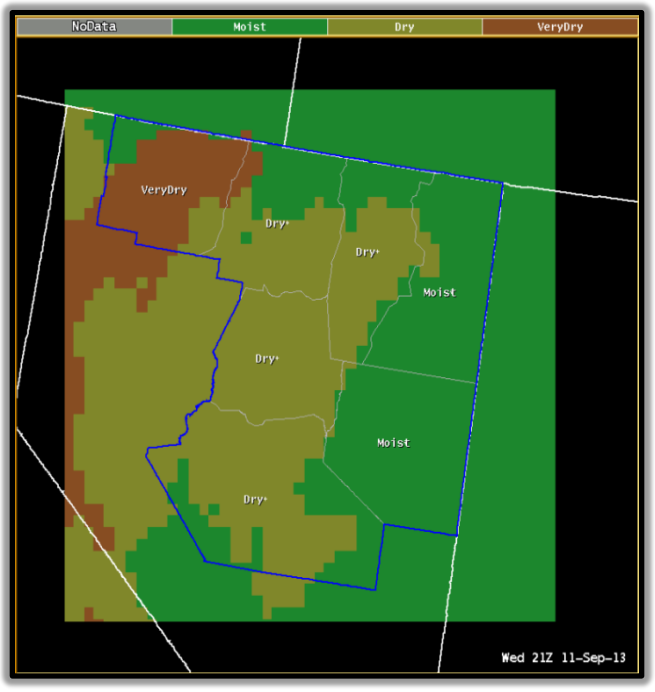
The HoTI not only looks at meteorological variables but also takes into account fuel moisture. The fuel dataset is from the USFS and BLM Predictive Service Meteorologists, working at the Geographical Coordination Centers or GACCs, across the country, who create dryness level for various "zones" within their areas of responsibility. The National Weather Service imports this dryness level dataset into their system to judge what the fuel conditions are. For a more detailed description on how the GACC Predictive Services calculate dryness levels please follow this link: http://gacc.nifc.gov/wgbc/predictive/weather/WGB_DL.pdf . There are some border differences between the GACC PSA and NWS fire weather zones. For this reason, we assign an individual PSA dryness value to a fire weather zone when the majority of the zone areas match up. When a fire weather zone is split between two PSA zones, we perform an average of the two PSA zones and assign that dryness value to the fire weather zone. Table 4 is a list of what PSA dryness value is assigned to which fire weather zone.

Fire Weather Zone	PSA
467	**WB01**
468	**Average WB02 & WB06**
469	**WB06**
470	**WB07**
454	**WB06**
455	**WB09**
457	**WB05**

Table 4



Map of Nevada Fire Weather Zones



GACC Dryness Level Forecast

GACC Predictive Service Area (PSA)

4. Creation of the HoTI

The threat index numerical values of relative humidity, wind gust, and lightning coverage are combined into one all-inclusive index for Day 1 and Day 2 forecasts. The final threat index is called the Holdover Threat Index value and is displayed in "None", "Limited", "Moderate", "High", and "Extreme" for each individual fire weather zone. Once the threat index is calculated, a final pass/fail is calculated for each zone based on the current fuel conditions. For example, if the fuels are considered "moist", then the HoTI for that corresponding zone is assigned a value of 0 because the fuels are not receptive to fire starts or growth. If the fuels are "dry" or "very dry", then the calculated HoTI value is passed "as is". If there is no data, the zone will also be assigned a value of 0.

Hold Over Threat Index Graphic Example

The following table depicts the different threat levels and what they mean:

Color Code	Threat Level	Lightning/Wind/R.H.	Threat Values
	None	No lightning, light winds, wet fuels	0-2
	Low	Isolated lightning, breezy winds, dry fuels	3-5
	Moderate	Scattered lightning, breezy winds, dry fuels	6-8
	High	Numerous lightning, high wind, dry fuels	9-11
	Extreme	Numerous lighting, high wind, low R.H.	12-14

Table 5

5. HoTI Forecast Creation Time

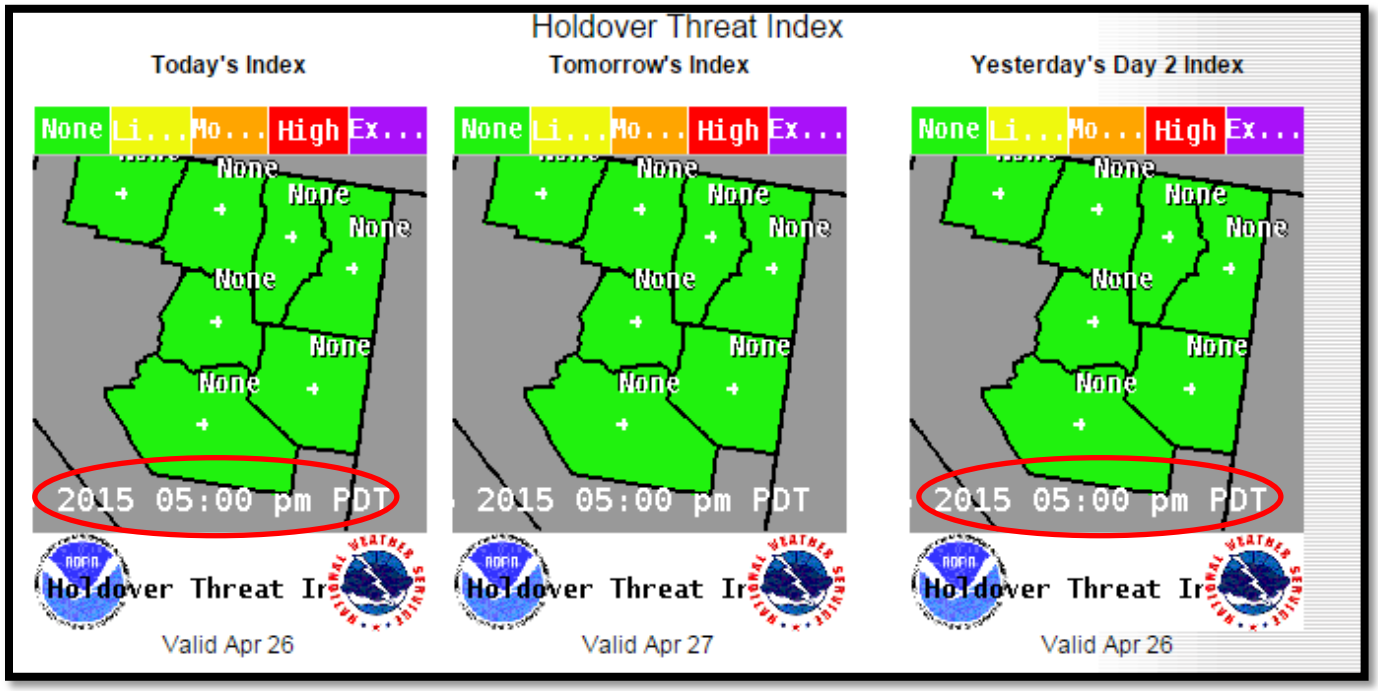
The National Weather Service in Elko will create the Holdover Threat Index graphics once daily by 6am PDT during the Great Basin GACC fire season. No forecast updates are currently planned for this product. All forecast graphics will be sent to the following web site URL: (http://www.wrh.noaa.gov/lkn/hoti/hoti.php). The HoTI forecast graphics will be created for Day 1 and Day 2. The Today's Index will be for the current afternoon. The wind and R.H. forecasts will be the current afternoon and the lightning coverage will be from the previous 24hrs (4am-4am). The Tomorrow's Index forecast will be based off of tomorrow's wind and R.H. forecasts plus the previous 24hrs of lightning activity. Thus, the Tomorrow's Index is actually based off the lightning activity from 48hrs ago.

6. Explanation of Webpage

There are basically two sections of the web page, and they are used for viewing the indices. Upon loading the web page, Section A will contain the Holdover Threat Index and will be shown here first. In

order to view a larger image, just left click on any Holdover Threat Index once. To revert back to the thumbnail images of the Index, left click on the larger image. There is a Today's Index which will be the current day forecast and a Tomorrow's Index graphic which will be the day 2 forecast.

In addition there is a third index graphic which contains **Yesterday's Day 2 Index** (previous days forecast cycle). What is the purpose of this graphic? The reason for this graphic is to provide the user with a continuity of forecasts for today to properly assess the threat. What this is saying is that **Yesterday's Day 2 Index** graphic will always be for the same forecast time as **Today's Index** graphic. You can see this by looking at the valid times in the lower right corner of the graphics.



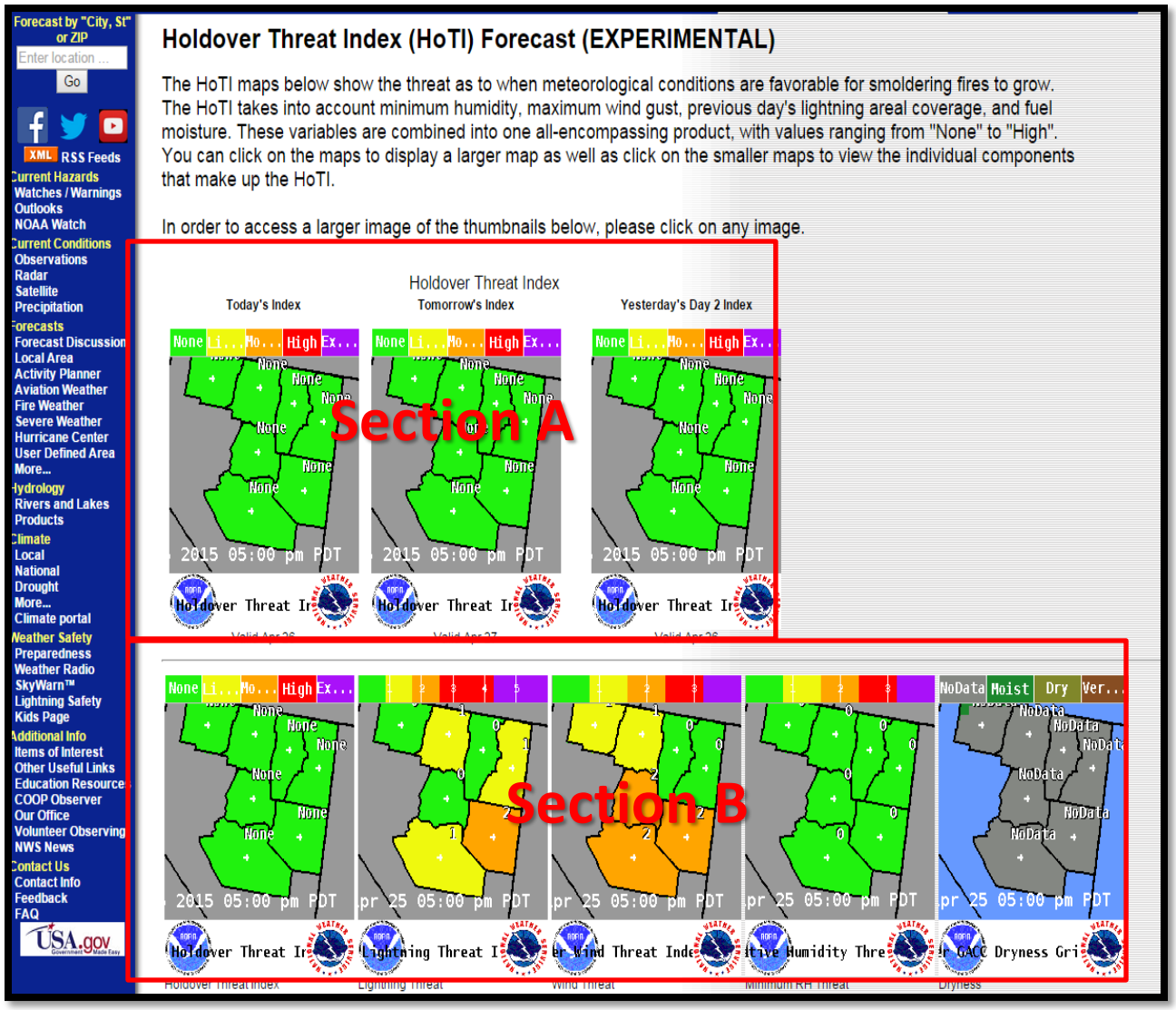
Webpage Graphic Showing Holdover Threat Index

For example, if today is Monday, then **Today's Index** is based off of Sunday's previous 24hr lightning activity, and **Yesterday's Day 2 Index** is based off of Saturday's previous 24hr lightning activity. By comparing **Today's Index** with **Yesterday's Day 2 Index,** you can see the difference in threat based off of 2 different days of lightning activity. Sticking with our example, let's say there was scattered dry lightning on Saturday and no lightning on Sunday. It is Monday morning and **Today's Index** is only showing a Limited threat due to low RH, but **Yesterday's Day 2 Index** is showing a Moderate threat for today due to scattered lighting and low RH. Thus, you can see in this scenario it is important to show the continuity of forecasts to accurately represent the Holdover Threat for the day.

Section B contains all four elements that go into the creation of the HoTI thumbnails, in addition to the HoTI graphic. To view the other elements (Lightning Threat, Wind Threat, Minimum RH Threat, and Dryness), just left click on any of the thumbnails in Section B. The element that is selected will be placed

in Section A, along with the times of the forecast. To view the full sized image, just follow the instructions discussed in Section A.

The process of selecting thumbnails and different indices can be repeated as many times as necessary to view the forecast.

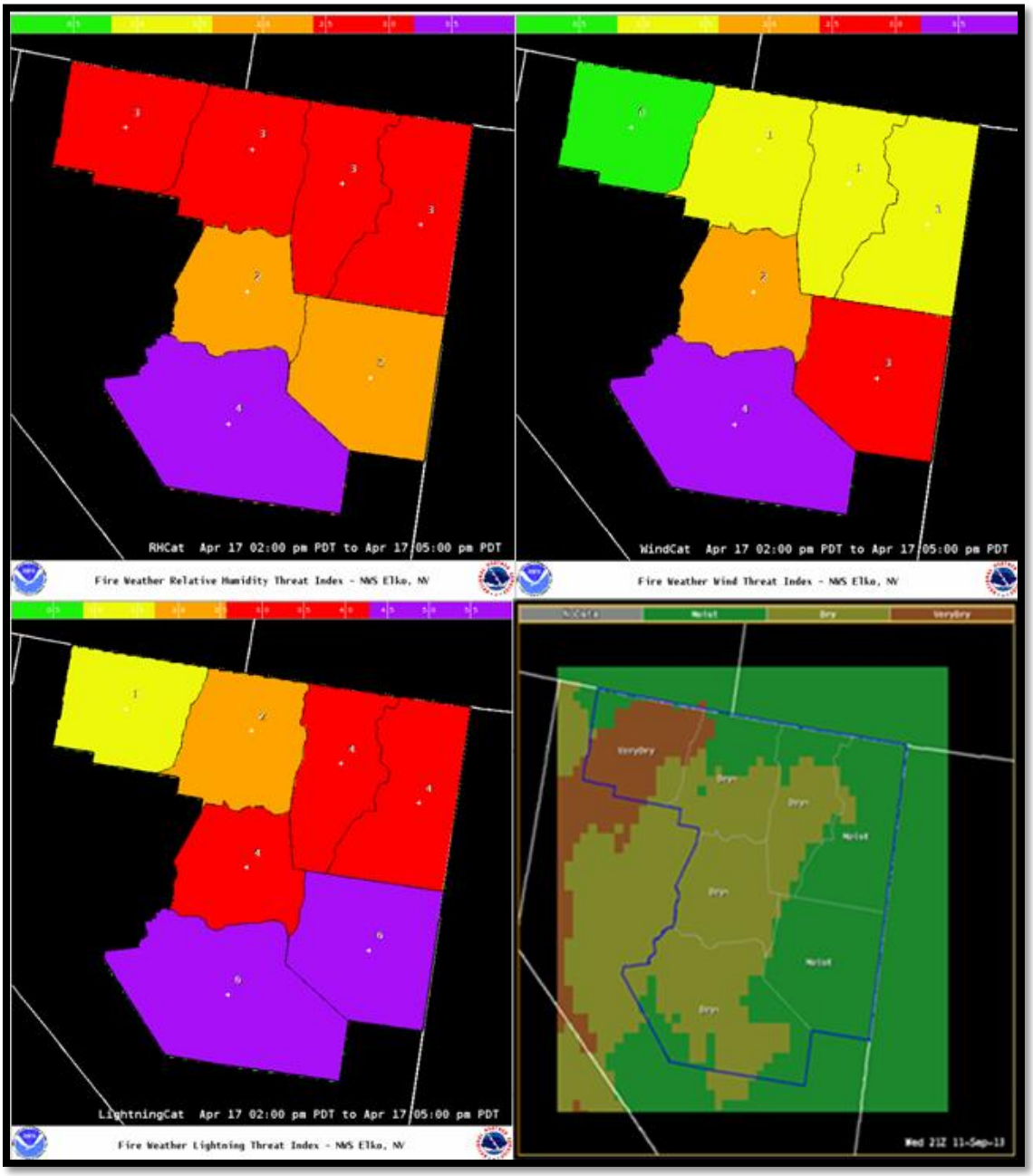


Sample Graphic of Web Page

7. Examples of Index Values

This following section will show an example of how the HoTI value is calculated.

Looking at the output data below for the 4 elements that account for the HoTI:



HoTI Example Graphics

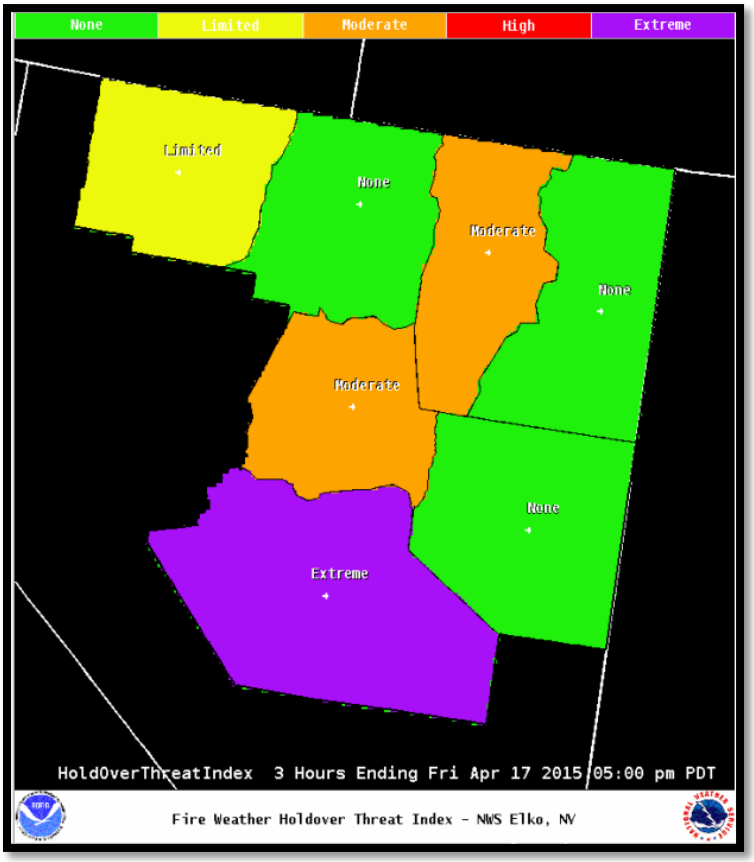
For each zone these are the corresponding values:

Zone	R.H. Index	Wind Index	Lightning Index	Fuel	HoTI
467	3	0	1	Very Dry	4
468	3	1	2	Moist	0
469	3	1	4	Dry	8
470	3	1	4	Moist	0
454	2	2	4	Dry	8
455	2	3	6	Moist	0
457	4	4	6	Dry	14

Table 6

Looking at the values in the HoTI column, you can see how it does not matter what the meteorological values are when the fuel moisture is in the "moist" category as it will always cancel out the values and assign a 0 value. This means there is no Holdover Threat for fire spread in that zone due to unreceptive fuels. Thus, this forecasted index is highly dependent on an accurate fuel moisture report.

The graphic below shows what the final HoTI graphic looks like with the assigned index values to each fire weather zone. To quickly highlight this graphic, you can see the three fire weather zones with moist fuel status are all green with no threat. Fire weather zone 457 has an “extreme” threat due to widespread lightning coverage, extreme minimum R.H. (5-15%) values and extreme wind gusts (>30mph). Looking at fire weather zone 469, even though it had high lightning activity and extreme minimum R.H. (<6%), low wind values kept the fire spread threat to just “moderate”.



Final HoTI Graphic